RESTRICTED CIRCULATION

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Shelter in an area congested with glasshouses

by J B Tyldesley

1. INTRODUCTION

In most experiments on the sheltering effects of hedges, the downwind area is free of obstruction, other than perhaps some low-growing crops. Many glasshouse growers are interested in shelter, for avoidance of structural damage, and more recently for reducing heat loss. On such sites, structures may be tightly packed on to a small area of land, so that the wind field in the lee of shelter is greatly modified by the structures themselves. As little is known about these effects, an exploratory experiment was mounted at Stockbridge House EHS during the glasshouse heating season of 1976/77, and this was repeated in 1977/78.

2. SITE AND EQUIPMENT

The attached plan shows the site, with details of the shelterbelts and buildings. Only the simplest equipment was available; cup-counter anemometers were mounted 2 m about the ground at positions A, B and C on the plan. The permanent meteorological station (A) has a flat and open exposure in all directions. At B, the sheltered site had only low-growing vegetable crops. The shelter at C was similar to B, but in the glasshouse area. Daily readings of run of wind were taken by the station staff at 09 GMT.

3. ANALYSIS

Wind direction was not measured at the site. So far as possible a general wind direction was assigned to each day, using the Daily Weather Report. Days of very variable wind direction, and a few dubious readings, were not used. Table 1 shows the frequency of winds from different directions. South and south-westerly winds predominated, but a reasonable coverage was obtained in all sectors. Table 2 shows the reduction in wind speed at B and C relative to A. The reductions are broadly in the range $\frac{1}{2}$ to $\frac{2}{3}$, and not very different at the two sites, with some variations with direction which can generally be explained with reference to the site plan.

The most interesting results concern the day-to-day variability of wind at the three sites, as shown in Table 3. The second line shows the coefficient of variation of run of wind at the unobstructed site A. If the reduction in wind speed at B and C was always by a constant factor, then the next two lines would be all zeros. The reduction factors at B are much more nearly constant than at the congested site C. Thus, on the daily scale the wind reduction on the glasshouse site is much more variable than it would be in the absence of glasshouses, though the mean speed is similar.

4. DISCUSSION

The glasshouses appear to have little effect on mean wind speed, but to cause increased variability of wind. This may mean that the shelter is more effective in saving fuel than in reducing structural damage. Measurements on a shorter time scale than one day would be necessary to decide this. Suitable equipment is now available.

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TABLE 1

Frequency of Winds from Different Direction, %

Direction		N	NE	E	SE	S	SW	W	NW	LV
Frequency	1977/78	6	9	6	7	18	23	12	11	7
	1978/79	6	6	2	8	12	25	14	13	14

TABLE 2

Mean Unobstructed Run-of-Wind (km in 24 hrs) from different Directions and % Reduction due to Shelter

Direction		N	NE	E	SE	S	SW	W	NW	LV
Run of Wind (km) at A	77/78	119	223	142	169	192	223	211	192	66
	78/79	252	186	124	184	174	220	217	226	92
% Reduction at B	77/78	65	65	66	65	73	79	74	70	67
	78/79	63	57	57	58	64	81	82	69	52
% Reduction at C	77/78	67	53	64	71	56	57	68	68	63
	78/79	56	54	(66)	64	59	62	82	73	64

TABLE 3

Coefficients of Variation of Daily Run of Wind and % Reduction, 1977/78

Direction	N	NE	E	SE	S	SW	W	NW	LV
CV of Run of Wind at A	44	25	31	46	43	33	53	45	42
CV of % Reduction at B	7	6	6	6	10	8	11	9	23
CV of % Reduction at C	35	14	23	38	23	29	20	17	36

LV = Light variable, and calm

Stockbridge House E.H.S
Shelter Belts and Glasshouses